

## Supplement 2. The Menthol Ban Scenario

We examine the impact of a menthol ban that is applied to both cigarettes and little cigars, so that substitution from menthol cigarettes to menthol cigars, especially little cigars, is minimal. We rely on a recent expert elicitation,<sup>16</sup> in which experts were asked to estimate the transitions in regular cigarette and NVP use under a menthol cigarette and cigar ban. We developed and pilot tested a questionnaire that focused on tobacco use transitions of current smokers (age 18-24 menthol, age 35-54 menthol, and age 35-54 non-menthol) and potential menthol smokers (age 12-24).

### Expert Selection

We adopted a three-pronged approach to the identification of experts. First, we selected lead and senior authors of studies identified in a scoping review on the impact of menthol and flavor bans.<sup>14</sup> Second, we searched Scopus to identify individuals who were among the most published authors on the topic of menthol tobacco. Similar to the method adopted by the FDA for their expert panel,<sup>21</sup> we selected the top 30 authors identified by Scopus and removed those with an H-Index of <20. Finally, we consulted expert advisors of our FDA-sponsored TCORS 2.0 Center (CAsToR) on their recommendations. We sent invitations to the 12 top-ranked experts requesting their participation. All but one invitee agreed to participate, leaving a final sample of 11 experts.

### Elicitation Process

First, we asked the experts to review a compilation of background materials. In the first round, experts completed an online questionnaire using the Qualtrics platform. For the second round, we shared the anonymized responses to the questionnaire along with a summary of the group mean, minimum and maximum for each transition with each participating expert. Experts were given the option of

revising their responses, which enabled them to consider others' answers and possibly move toward consensus.<sup>17-19</sup> In addition to their revisions, we also asked experts to indicate their level of confidence for each question (1=not at all to 4=very).

### **Method Used to Estimate Transitions in the Menthol Ban Scenario**

For each age/menthol group, we estimated average net transitions under the ban. Individual net transitions were calculated as the change in use for each product category between the Status Quo and Menthol Ban Scenarios, i.e., the net transitions due to the ban. For example, if an expert indicated that out of 100 menthol smokers, 40 would transition to NNDPs under the status quo and 60 under the menthol ban, then the net transition due to the ban is 20 (=60–40). We then calculated the mean net transition over all 11 experts. While different combustible products were included in the Status Quo and Menthol Ban Scenarios, we aggregated all combustibles (cigarettes and cigars) into a category of total combustibles. Experts were first asked about transitions by those ages 12-24 who would have otherwise initiated into menthol cigarette use. The process allowed for transitions through the age of 30 for initiation. The experts were then asked to estimate the transitions under a ban by menthol smokers at age 18-24 and 35-54, and non-menthol smokers age 35-54 for both genders. The outcomes include "continue to be (illicit) menthol smokers," "switch to non-menthol smoking," "switch to cigar use," "switch to smokeless tobacco use," "switch to NNDP" (novel nicotine delivery products, and "quit" (discontinue any nicotine product use). For the 18-24 and 35-54 years old age groups, experts were asked transitions over a two-year period under the Status Quo (no ban) and under the menthol Ban. In developing the relevant transitions for the model, we use the difference in these transitions for each product category in order to obtain the net change as a result of the ban. In characterizing each of the transitions, illicit menthol cigarette users are retained as menthol smokers, with the same cessation and switching rates as menthol cigarette smokers in the **Menthol Ban Scenario**

We consider transitions into cigar use as non-menthol cigarette use to create a change in combustible use. This is a conservative strategy in that the health impacts are similar or less for cigars compared to cigarettes. Since the experts indicated little impact of menthol ban (?) on smokeless use (2% for ages 18-24 and <1% for ages 35-54), those users are assumed to transfer to non-menthol cigarette use (a conservative strategy). Although the survey also allowed for switching to heated tobacco and HTP risks are similar to NVPs, transfers to NNNDP use are assumed to all be into NVP use. While compiling the inputs from 11 experts, one expert gave anomalous response that “most menthol smokers will switch to non-menthol cigarette, NVP and smokeless tobacco in the status quo scenario” and “most menthol smokers will switch to non-menthol cigarettes, and those who would switching to NVPs, smokeless or quit smokers will allow switch to non-menthol cigarette”. Since his response deviates greatly from the rest of the experts, his response was removed from the sample.

Based on estimates from the experts for would-be menthol smokers at ages 12-24 in the Menthol Ban Scenario (Table S2.1), we use the mean net transition to model the decomposition of the would-be menthol smokers in the Menthol Ban Scenario (Figure S2.1 below). The transitions are multiplied by the former menthol initiation rate at each age for each gender through age 40, where M1=2.4% become illicit menthol smokers, M2=38.3% (=30.3%+5.6%+2.4%) become non-menthol smokers (including non-menthol cigar users and smokeless users), M3=17.3% become NVP users, and the remaining 42.0% are transferred back to never smokers. Never smokers are kept in a separate permanent never smoker category, so that they do not later initiate into the NVPs use and smoking. This allows for increased initiation of non-menthol smoking and vaping. The same level of transitions of would-be menthol smokers is assumed in all future years after the menthol ban, thus leading to increasing effects of a ban over time.

For transition rates from current menthol smokers (ages 18-24 and ages 35-54) in the Menthol Ban Scenario (see Figure S2.2), we

do not directly apply experts' estimates for the Menthol Ban Scenario because of their dependence on the Status Quo scenario. Instead, we use the difference between experts' estimate in the Status Quo and the menthol ban scenarios to re-distribute would-be menthol smokers in the Menthol Ban Scenario. These transitions are in terms of direct transitions in prevalence. While transitions in the expert elicitation are within a two-year period, we assume the original change in prevalence takes place in the first year for simplicity. That change is maintained over time subject to the cessation rates of the respective products. After the first year of menthol ban when a sudden reduction in the menthol smoking prevalence is incorporated, all the remaining menthol smokers become illicit menthol smokers but their cessation rate and switching rate to NVP use in the following years are assumed to be the same as what were assumed for menthol smokers in the Menthol Status Quo Scenario and no switching to non-menthol smokers anymore. Consequently, a menthol ban continues to have long term effects (in future years) through the increased (Status Quo) cessation rate of non-menthol smokers who have switched from menthol smoking.

Based on the expert data for menthol smokers ages 18-24 (Table S2.2), we estimated the difference between the Status Quo scenario and the Menthol Ban Scenario and computed the increment of each group relative to the diminished menthol cigarette smokers as shown in Figure S.2.2. Based on the expert elicitation, 10.1% switch to illicit menthol cigarettes or cigars, 48.0% (43.8%+0.9%+3.3%) switch to non-menthol cigarettes, 24.2% switch to NVPs and 17.7% quit. These transitions are multiplied by the menthol cigarette smoker prevalence at each age by gender. While the expert elicitation was in terms of ages 18-24, we allowed the transitions to occur through age 30. Thus, the transitions from current menthol smokers ages 18-30 are modelled as a one-time change.

The transition rate for menthol smokers ages 35-54 (Table S2.3) is obtained based on experts' estimates of the difference between

the Status Quo and Menthol Ban Scenario for those ages 35-54. As shown in Table S2.3, 8.8% switch to illicit menthol cigarettes or cigars, 59.2% (54.5%+3.7%+1.0%) switch to non-menthol cigarettes, 17.3% switch to NVPs and 14.7% quit. These transitions are multiplied by the menthol cigarette smokers prevalence by age and gender. While the expert elicitation was in terms of ages 35-54, we allowed the transitions to all menthol smokers above age 30.

For the transition rate from non-menthol smokers age 35-54 in the Menthol Ban Scenario, we allow for no change compared to the rate in the Status Quo Scenario based on the results in Table S2.4.

**Table S.2.1. Transitions of Ages 12-24 Who Would Have Initiated as Menthol Smokers under a Menthol Ban, in Percentage Terms (out of 100 age 18-24 menthol smokers in the Status Quo)**

Population	Status Quo	Total Population with Menthol Ban			
		Mean	Median	Min	Max
Become non-menthol cigarette users (exclusively or with other products)	0	30.3	25.0	1.9	79.0
Become non-menthol cigar users (exclusively or with other products, but not cigarettes)	0	5.6	2.0	0.0	20.0
Become illicit menthol cigarette or cigar user	0	2.4	1.0	0.0	10.0
Total combustible use (status quo all menthol cigarettes)	100	38.3	35.0	3.5	83.0
Become exclusive smokeless tobacco or other oral tobacco product users	0	2.4	2.0	0.0	5.0
Become novel nicotine delivery product users (NNDP), such as e-cigarettes or heated tobacco products (exclusively or in combination with other products, but not cigarettes or cigars)	0	17.3	20.0	3.4	25.0
No tobacco or novel nicotine delivery product use	0	42.0	41.0	6.0	92.3

**Table S.2.2. Transitions of age 18-24 Menthol Smokers in the Status Quo and Menthol Ban Scenarios in Percentage Terms (out of 100 age 18-24 menthol smokers in the Status Quo)**

Population	Status Quo	Menthol Cigarette and Cigar Ban	Net Effect	Final Transition as a Percent of Menthol Smokers in the Status Quo
Product Type	Mean	Mean	Absolute difference	Percent of 71.2%
Continue to be menthol cigarette smokers (exclusively or with other products)	71.2	-	-71.2	
Switch to non-menthol cigarettes (exclusively or with other products, except menthol cigarettes)	5.6	36.8	31.2	43.8% (31.2/71.2)
Switch to cigars, especially little cigars, filtered cigars, or cigarillos (exclusively or with other products, but not cigarettes)	3.4	-	0.7	0.9% (0.7/71.2)
Switch to non-menthol cigars, especially little cigars, filtered cigars or cigarillos (exclusively or with other products, but not cigarettes)	-	4.1		
Switch to illicit menthol cigarette or cigar use	-	7.2	7.2	10.1% (7.2/71.2)
Switch to exclusive smokeless tobacco or other oral tobacco products	1.7	4.1	2.4	3.3% (2.4/71.2)
Switch to novel nicotine delivery products (NNDP), such as e-cigarettes or heated tobacco products (exclusively or in combination with other products, but not cigarettes or cigars)	8.3	25.5	17.2	24.2% (17.2/71.2)

Quit regular use of all tobacco or novel nicotine delivery products	9.8	22.4	12.6	17.7% (12.6/71.2)
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**Table S2.3. Transitions of Age 35-54 Menthol Smokers in the Status Quo and Menthol Ban Scenarios in Percentage Terms (out of Age 35-54 100 menthol smokers in the status quo)**

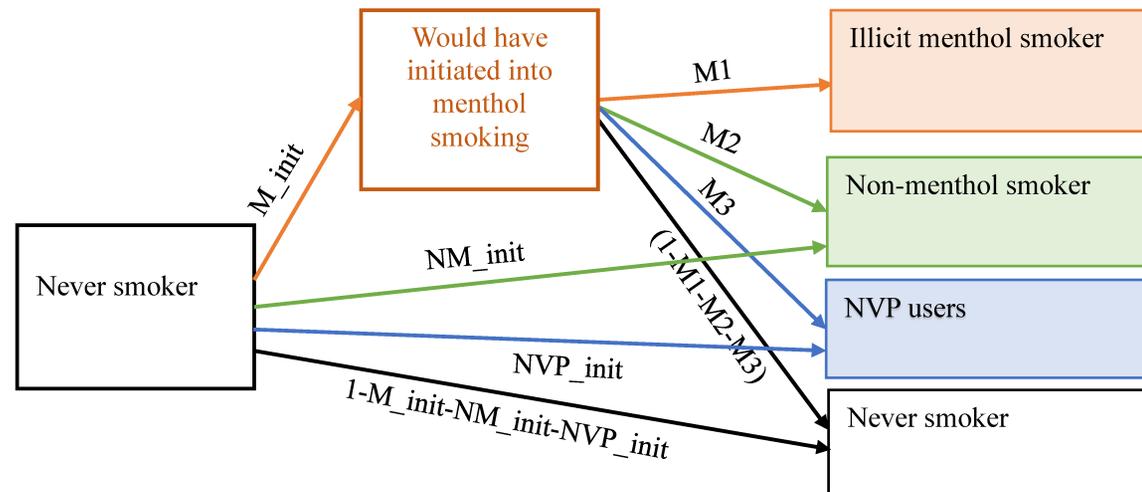
<b>Population</b>	<b>Status Quo</b>	<b>Menthol Cigarette and Cigar Ban</b>	<b>Net Effect</b>	<b>Final Transition as a Percent of Menthol Smokers in the Status Quo</b>
<b>Product Type</b>	<b>Mean</b>	<b>Mean</b>	<b>Absolute difference</b>	<b>Percent of 71.2%</b>
Continue to be menthol cigarette smokers (exclusively or with other products)	71.2	-	-71.2	
Switch to non-menthol cigarettes (exclusively or with other products, except menthol cigarettes)	4.5	43.3	38.8	54.5% (38.8/71.2)
Switch to cigars, especially little cigars, filtered cigars, or cigarillos (exclusively or with other products, but not cigarettes)	1.5	-		
Switch to non-menthol cigars, especially little cigars, filtered cigars or cigarillos (exclusively or with other products, but not cigarettes)	-	4.1	2.6	3.7% (2.6/71.2)
Switch to illicit menthol cigarette or cigar use	0.0	6.3	6.3	8.8% (6.3/71.2)
Switch to exclusive smokeless tobacco or other oral tobacco products	1.9	2.6	0.7	1.0% (0.7/71.2)
Switch to novel nicotine delivery products (NNDP), such as e-cigarettes or heated tobacco products (exclusively or in combination with other products, but not cigarettes or cigars)	8.2	20.5	12.3	17.3% (12.3/71.2)
Quit regular use of all tobacco or novel nicotine delivery products	12.7	23.2	10.5	14.7% (10.5/71.2)

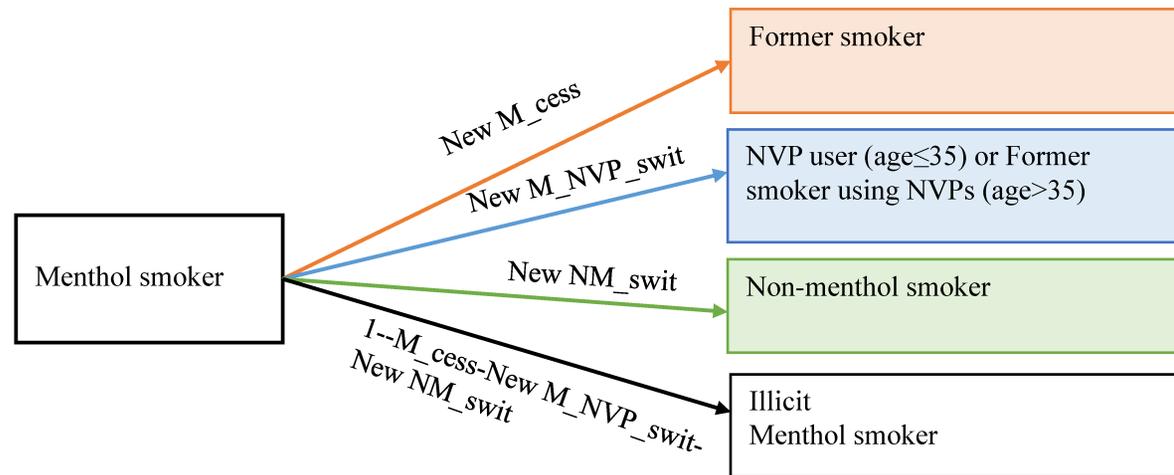


**Table S.2.4. Transitions of Non-Menthol Smokers at Age 35-54 in The Status Quo and Menthol Ban Scenario**

<b>Population</b>	<b>Status Quo</b>	<b>Menthol Cigarettes and Cigars Ban</b>	<b>Absolute difference</b>
<b>Product Type</b>	<b>Mean</b>	<b>Mean</b>	
Switch to be menthol cigarette smokers (exclusively or with other products)	2.3	-	-2.3
Continue to smoke non-menthol cigarettes (exclusively or with other products, except menthol cigarettes)	75.3	76.9	1.6
Switch to cigars, especially little cigars, filtered cigars, or cigarillos (exclusively or with other products, but not cigarettes)	0.8	-	-0.8
Switch to non-menthol cigars, especially little cigars, filtered cigars or cigarillos (exclusively or with other products, but not cigarettes)	-	1.1	1.1
Switch to exclusive smokeless tobacco or other oral tobacco products	1.8	1.7	-0.1
Switch to novel nicotine delivery products (NNDP), such as e-cigarettes or heated tobacco products (exclusively or in combination with other products, but not cigarettes or cigars)	8.4	8.5	0.1
Quit regular use of all tobacco or novel nicotine delivery products	11.4	11.8	0.4

Figure S.2.1: Transitions from Never Smokers in the Menthol Ban Scenario



**Figure S.2.2 Transitions from Menthol Smoker in the Menthol Ban Scenario**

## References

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